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SCIENCE

FRIDAY, OCTOBER 12, 1888.

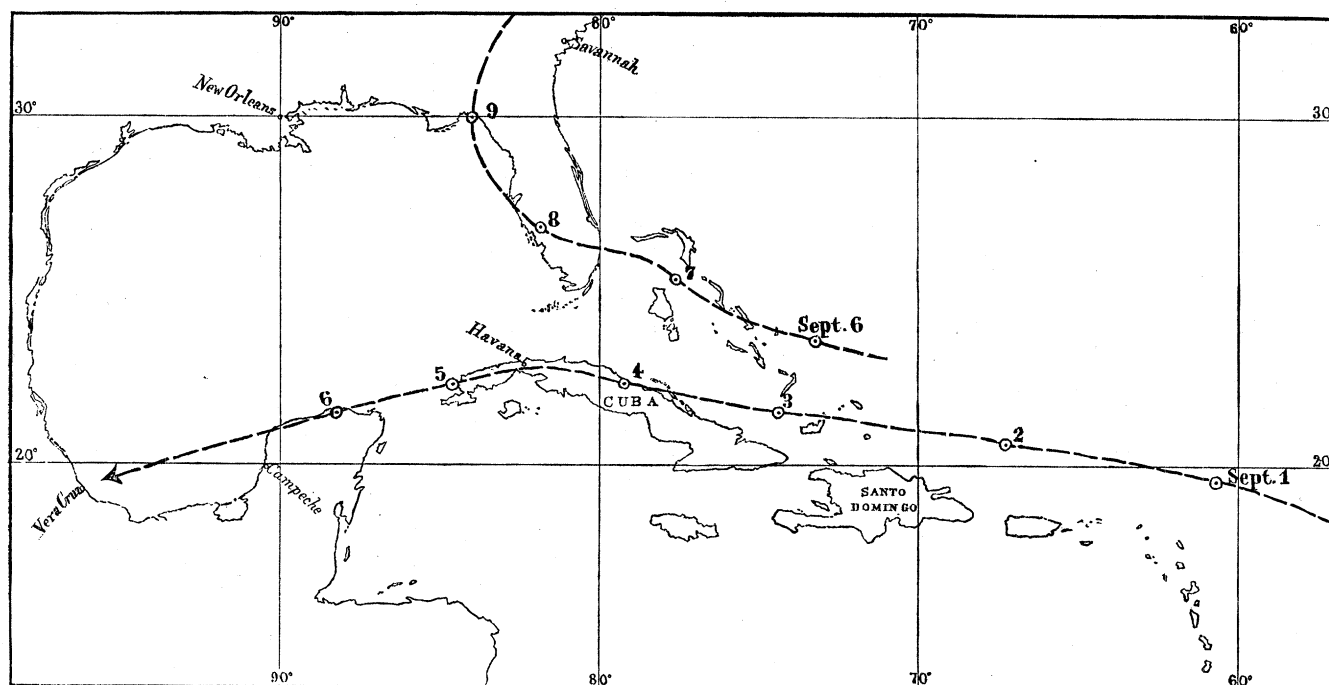
THE SUNDRY CIVIL APPROPRIATION BILL, passed by Congress, has finally been signed by the President, and the grants of money it makes have become available. Among these is one of a hundred thousand dollars, to enable the United States Geological Survey to begin an inquiry in regard to the feasibility of reclaiming the arid lands of the Far West. The sum is not as large as might be profitably used for this purpose, but it will enable a beginning to be made and an organization of the work to be effected. The amount of progress that may be made between now and July, 1889, is much less important than the determination reached by the government to enter upon this great work. This has not been hastily

SCIENTIFIC NEWS IN WASHINGTON.

The Cuban Hurricane. — Tree-Growth on Arid Lands: Forests have Little Effect upon Climate: They do promote Agriculture.

The Cuban Hurricane.

MR. EVERETT HAYDEN of the Hydrographic Office, whose visit to Cuba for the purpose of studying West Indian hurricanes has been mentioned in a previous number of *Science*, reports to the Hydrographic Office that upon his arrival at Havana he placed himself in communication with the Rdo. Padre Benito Viñes, of the Observatory of the Real Colegio de Belen, who has done every thing in his power to facilitate his work. Assisted by this eminent meteorologist, Mr. Hayden immediately began the investigation of the great hurricane that caused such destruction in the island of



TRACK OF THE CUBAN HURRICANE.

done, or without a full comprehension of the ultimate magnitude of the undertaking, or of the vast possibilities involved in it. The subject was very ably discussed, both in the Senate and House of Representatives, and, what is very remarkable, the debates took place at a time when the political excitement that pervaded both bodies was so great as almost to preclude the consideration of any new question of as great importance as this. It may not be that the amount of land that can be reclaimed from present worthlessness, and converted into rich agricultural lands, will equal in extent the entire area now under cultivation in the United States, as Major Powell has estimated; but, if one-half of this result is realized, the wealth of the country will be increased as it never has been increased before. Homes will be provided for additional millions of industrious people, and the amount of the natural products of the country will be increased almost beyond our present comprehension. It is an appreciation of these facts that causes us to consider the determination of the government to enter upon this great enterprise as the most important public business of the present year.

Cuba from the 3d to the 5th of September. One of the first features, and probably the most remarkable, noticed, was the exceptional and wholly unexpected change of direction in the onward movement of the cyclone on the night of the 4th, from about west by north to the south of west. Such a marked departure from the paths usually followed by these storms in low latitudes at once excited the curiosity both of Padre Viñes and the Hydrographic Office. The cause of this phenomenon seems to have been the presence, not far to the eastward, of another well-defined hurricane, which apparently exerted a marked influence upon the first and more violent one. This influence was shown in a variety of ways, but the details of its operation are still a subject of some uncertainty. According to Viñes, two barometric depressions, starting at about the same time and in the same neighborhood, exert a repellent influence upon one another in the upper currents. The reason assigned is, that the air, after rushing to the centre of the cyclone, rises rapidly, as in a sort of funnel, and when the top is reached (i.e., when, having reached an atmosphere of its own temperature, there is no longer a tendency to rise) the currents flow radially outward towards the circumference of the cyclonic area; and, when two depressions are near enough, these upper currents will meet and repel each

other. Viñes admits, however, that the currents at the surface of the earth tend to make the barometric depressions converge and unite.

In accordance with this theory, the upper currents of these two great barometric depressions met and caused the divergence in the two storms, — one to the south and west, the other to the east and north.

The theory at present favored by the hydrographer, while not denying the possible influence of upper currents, according to that of Viñes, takes into consideration only the surface currents as furnishing sufficient data to explain the phenomenon. Briefly stated, it is to the effect that an energetic area of high barometer was central over the Middle Atlantic States during the occurrence of the two cyclones, the second of which caused the extensive southward rush of air from the high area to impinge against the first low, instead of encircling it. The natural result to be expected from this would be the forcing of the latter to the southward, which actually took place. In addition to this, a third low area is stated to have passed westward over Jamaica on Sept. 3; and this might have tended still more to draw the first low (the great hurricane) towards the south, on the principle that adjacent depressions of the barometer on the earth's surface have a tendency to converge, — a theory favored by Viñes, as noted above.

The results of the labors of the Hydrographic Office promise to be of great interest and value to both meteorologist and mariner, in connection not only with the great storm which has just occurred, but with regard to hurricanes in general.

Trees on Arid Lands.

Major J. W. Powell, director of the United States Geological Survey, has written the following interesting letter to the *Kansas City Times*, thus making a valuable contribution to the discussion of the subjects of forest-growth on arid lands, the effects of hot winds, and the extent to which irrigation may change the agricultural climate of the plains: —

"The plains are treeless because they are arid. There is an opinion widely existing in the popular mind, and springing up in the current literature of the West, which is opposite to this, to the effect that the dryness of the climate is the result of the lack of forests. An argument in favor of tree-planting and forest-culture has often been based on this error. The effect of forests upon rainfall has been investigated by many methods, in many countries, and at many times, and the result of all this investigation shows that the presence or absence of trees influences the general rainfall or amount of precipitation only to a very limited degree. It is, in fact, not certain that their presence does increase rainfall; but it is certain, that, if it does, the increase is so slight as to play but an insignificant part as a climatic factor.

"Yet forests, or abundant trees, exert an influence upon climate in its relations to agriculture. Two ways in which this influence is exerted are worthy of careful consideration.

"First, While it is not probable that forests diminish or increase the total amount of rainfall in any country, yet it appears that forests regulate this rainfall, so that there are fewer fierce storms and more gentle rains. When the rains fall in storms, the water is speedily gathered into streams, and at once passes from the country; but, when they fall in gentle showers, time is given to moisten the soil and invigorate vegetation.

"Second, Forests provide against the speedy evaporation of the water by protecting the lands from the fierce rays of the sun, and more especially by protecting the land from the rapid passage of dry winds, which drink up the water from the soil and growing plants with great avidity.

"It is manifest that the effect of the forests upon the great movements of the atmosphere must be very slight when due regard is given to proportions between cause and effect. Forests can affect only the winds close to the earth by creating a friction at the surface; but the soil, and the smaller plants growing therein, may be greatly sheltered by trees. Though the general climate may be scarcely affected, the agricultural climate may be materially modified.

"The relation of forests to humidity, and of prairies and plains to aridity, should be clearly understood. In middle latitudes, and

under average conditions of relative humidity, low, gnarled forests will be produced with about ten or twelve inches of rainfall; that is, in the Rocky Mountain region, and generally on the Great Plains, forests of cedar and pinon can be produced with a little more than ten inches of rain annually. Now, this is a well-established fact. Why, then, are the arid valleys and Great Plains treeless? The answer is, that the fires destroy the trees, and prevent their growth. In a region of great humidity, say, of forty inches or more of rainfall, forests are largely protected from fire by such general humidity. In regions of country having from ten to twenty-five inches of rainfall, all forests are destroyed unless protected by art or topographic position. In regions having between twenty-five and forty inches of rainfall, prairie-lands interspersed with timber-lands will usually be found; that is, in ordinary seasons, trees will be protected from destructive fires by the general humidity, but in excessively dry seasons the trees will be destroyed, now here, now there: so that, by the natural process of tree-propagation, the forests will encroach on the prairies, and through the fires of excessively dry seasons the prairies will encroach on the forests; and so prairie conditions and forest conditions forever contend with each other for the possession of a sub-humid land. In the direction in which aridity increases, prairie conditions will more and more prevail; and, as humidity increases, the forest condition will more and more prevail. In general it may be stated, that, other things being equal, the dryer the climate, the smaller the forests; the wetter the climate, the greater the forests; for, although the rainfall may be sufficient to grow forests, it may not be sufficient to protect them from fires. The Great Plains and the valleys of the Rocky Mountains are all capable of sustaining forests of certain trees adapted to the climatic conditions found therein.

"It is possible, and in due time it will be practicable, for man to clothe the naked lands of the Great Plains and the arid valleys of the West with forests without artificial irrigation. From this must be excepted certain desert-lands west of the lower portions of the Colorado River, where the rainfall is insufficient, and also certain tracts of bad-lands which will always be treeless for reasons that need not here be described.

"The amount of rainfall necessary to produce forests in any given latitude will depend to some extent upon the character and conditions of the soil, some soils needing more rain than others for this purpose; but the soil condition has narrow limits.

"If it be true, as has been asserted above, that the arid plains and valleys may all produce forests without artificial irrigation if protected from fires, how are such forests to be planted, in what manner can they be protected, and how shall the trees adapted to the climate be selected? These are the practical problems to be solved.

"Great areas of uninhabited land cannot be redeemed and protected: the protection must come from men living on the land, and utilizing it for agricultural and pasturage purposes. The way in which this can and will be done may be briefly and crudely sketched as follows: —

"Adown the valleys and across the plains flow many streams of water — brooks, creeks, and rivers — that have their sources in the mountains by which the arid lands are dissected; and all of these streams can be utilized to irrigate the dry and parched lands that now present the desolation of deserts. By their use many tracts of land scattered far and wide throughout the whole country may be brought under cultivation, and covered with growing fields and luxuriant groves. In this manner populous and prosperous settlements may be distributed throughout that land of drying winds and scorching suns. When industrious and thrifty people once get a foothold in this manner, they plant orchards and vineyards, and surround their farms and fields with trees, and plant them by the roadside, and every man devotes a part of his farm to timber-culture, and the naked lands are speedily covered with a rich vegetation. A generation ago the prairie region east of the Missouri River was so destitute of forests that large districts were supposed to be practically uninhabitable; but since that time it has been covered with orchards, vineyards, and groves, and now, from the lands that were once so naked, millions of trees spread their branches to the breezes. In the same manner, by means of artificial irrigation, great numbers of tracts of land will be cultivated throughout the

arid country, and diversified groves will be developed. But not all the arid lands can be redeemed, as the water of all the living streams is inadequate to the task; but the intervening land will be utilized for pasturage purposes, and will be protected by the people from fire, and groves will be planted, and the face of the country not under cultivation will be forested.

"In the region practically uninhabited the water now flows from the mountains to the sea; but, when the streams are utilized in irrigation, the water will be evaporated, and the humidity of the climate will be increased thereby, and dry winds will no longer desiccate the soil and shrivel the vegetation. As the general humidity is increased, the moister air, as it drifts eastward in great atmospheric currents, will discharge more copious rains, and the humid region will extend farther westward, and the arid region will correspondingly shrink in its proportions. Irrigation will increase the humidity of the climate, and increase protection from fires to the non-irrigated lands; and, as the lands gain more and more water from the heavens by rains, they will need less and less water from canals and reservoirs. When all the water of the arid country is ultimately appropriated for irrigation by using all the streams through the season of irrigation, and by storing the surplus that flows through the non-growing season, and by collecting in reservoirs the storm-waters of the streamless valleys, the general humidity of the atmosphere in the arid region will be increased, and hence the rains will be increased, and a smaller amount of artificial irrigation will be needed. By all of these means a large share of the arid lands will be redeemed. But all will not be redeemed: there will still be extensive areas of pasturage-lands not under the plough, for all that man may do will be insufficient to radically change the climate. The non-irrigated lands can be greatly improved by extensive tree-planting; but as these trees are to be supported by the general rainfall, which is scant, it will be necessary to select trees adapted to arid conditions, and this will require extensive experimentation. The wide distribution of the cedar, and of the pinon or nut-pine, throughout the country under consideration, points out the fact that these two trees may be widely used; but there are many others on the Pacific coast which perhaps will be more valuable; and it will probably be found that there are many trees in the arid lands of the eastern hemisphere which can be introduced with advantage. But this tree-planting is a question of a somewhat remote future. At present the trees planted in the arid region will depend for their existence and vigorous growth upon irrigation, and the experiments demanded at the present time must be with such trees.

"The great currents of air which now traverse the plains are impelled by agencies that produce the general circulation of the atmosphere throughout the globe, modified by the general configuration of the plains in its relation to the mountains of the West and the low humid lands of the East. These general conditions cannot be modified by man; and the storms will come and the winds will blow for ages as they now do, unchanged by the puny efforts of mankind; and yet the agricultural conditions of the country may be greatly modified and improved by the efforts of man. Man cannot change the great laws of nature; but he can take advantage of them, and use them for his purposes.

"There is a theory held by some persons in the West that rainfall is largely dependent upon the electrical conditions of the atmosphere, and that these conditions are modified by the various changes wrought by the hand of man in the settlement of the Great Plains. As this appeal is to some occult agency, it becomes quite popular to those who love to revel in the mysteries of nature. Of course, it is never explained. It is a case where cause and effect are confounded. Atmospheric electricity is the result of certain conditions and movements in the atmosphere. To explain atmospheric changes by attributing them to electricity is like explaining the origin of the fire by the light it produces, or like explaining the explosion of the powder in the cannon by attributing it to the roar which may be heard in the distance. The electricity in the air is related to atmospheric changes as effect is related to cause.

"In conclusion let it be said, first, that a large body of the arid lands can be redeemed by irrigation, and that the agriculture resulting therefrom will be in the future, as it has ever been in the past, the highest condition of agriculture, for the agriculture which

is dependent upon rains is subject to storms on the one hand, and to droughts upon the other; but, when the water-supply is properly controlled by the arts of man, the soil is made to yield its most abundant returns; second, that, under the culture and protection of man, vineyards, orchards, and groves can be established over vast areas, where, under the control of nature, only deserts are found; third, the siroccos of the Great Plains cannot be tamed, but men may protect their homes, their gardens, and their fields from devastation by them; fourth, the lightnings of heaven cannot be employed to bring rain upon the plains, but electricity may be used to illumine the cities and towns and hamlets that must ultimately spring up over all that land."

HEALTH MATTERS.

Recovery from Lightning-Shock.

DR. J. B. PAIGE read before the Medico-Chirurgical Society of Montreal an account of a case of lightning-shock which resulted in recovery.

The accident occurred in Prescott, Mass., during a terrific thunder-storm, July 29, 1887, about five o'clock P.M.

Lightning struck the house, to all appearances the chimney of the upright part first. At the roof the current divided into three parts, one following the chimney down to the floor of the second story, then passed along a stove-pipe out of the chimney, and partly to a nail in the floor by the legs of the stove, and thence by the timbers to the earth. A second subdivision of the current followed a rafter on the north side of the roof, after leaving which it could not be traced. This rafter was completely torn from its place. A third current passed down a rafter on the south side of the roof. At the lower end it divided again, one portion following the finish of the roof, passed along the other side of the L to the opposite corner, followed the track of a rolling-door, and reached the earth by the corner post of the house. The other part coursed along the studding of the house, near the window, and passed to the earth. Attached by a screw to the upper casing of the window was a large iron hook on which was suspended, by a brass chain, a bird-cage. One part of the current, going by this chain to the bird-cage, left it at one corner, entered the body of the subject of the accident, and left the room by a nail in the floor.

That the electrical influence in this quarter was intense, is proved by the fact that the links of the chain in some places were nearly melted apart, while the solder at the corner of the cage, where the fluid left, was completely melted. Again, the nail by which it passed through the floor was considerably roughened. It appeared as if it had been partially melted at a high temperature.

The patient was thrown from the chair in which she was sitting, directly across another chair, a distance of two or three feet. She was taken out to the piazza immediately, and her condition was found to be as follows: completely unconscious; motionless; muscles relaxed; left eye closed, right open; face purple; pulse at wrist imperceptible; neither heart-sounds nor respiratory murmur to be heard.

Later, an examination showed the course of the electric current to be as follows: it struck the head above the left eye, midway between the eyebrow and hair, which was apparently the part nearest the corner of the bird-cage; passed along in front of the ear, then to the central line of the thorax, descending by the stocking-supporter, which was attached to the corsets; thence to the top of the stockings, leaving marks upon both limbs, but more especially upon the left, on the back of which, just above the knee-joint, was a burn about the size of one's hand. It had the appearance of an ordinary burn, and was only superficial. No trace of the current could be detected again until the foot was reached, from which it passed off by the joint of the great toe, tearing a place about two inches in diameter in the stocking and slipper, but not leaving the slightest mark upon the skin. With the exception of the burned spot on the posterior part of the left leg and one or two small burns on the body and the right leg, hyperæmic lines alone marked the course of the electricity in its passage over the body.

After removal of the patient to the piazza, the clothes about the neck and chest were loosened, and artificial respiration commenced.